

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An inductive coil assembly comprising:

5 a first coil arranged at a first orientation to receive at least one of inductively transmitted power and inductively transmitted communications;

a second coil arranged at a second orientation to receive at least one of inductively transmitted power and inductively transmitted communications, said first orientation being different from said second orientation; and

10 wherein said first coil and said second coil are electrically connectable to an electronic device, whereby the electronic device receives at least one of power and communication from at least one of said first coil and said second coil.

2. The inductive coil assembly of claim 1 further comprising a third coil at a third orientation to receive at least one of the inductively transmitted power and inductively
15 transmitted communications, said third orientation being different from said first orientation and said second orientation.

3. The inductive coil assembly of claim 2 wherein said first orientation is substantially perpendicular to said second orientation.

4. The inductive coil assembly of claim 3 wherein said second orientation is substantially
20 perpendicular to said third orientation; and

said third orientation is substantially perpendicular to said first orientation.

5. The inductive coil assembly of claim 4 further including a bobbin; and

wherein each of said first coil, said second coil, and said third coil are wrapped about said bobbin.

6. The inductive coil assembly of claim 5 wherein said bobbin include a first spool, a second spool and a third spool.

5 7. The inductive coil assembly of claim 6 wherein said first spool, said second spool and said third spool are integral with one another.

8. The inductive coil assembly of claim 1 further including a rectifying means for rectifying and combining an alternative current induced in each said coils, said rectifying means being electrically connected with each of said coils, whereby a resultant direct current is
10 provided.

9. An inductive coil assembly comprising:

a first coil arranged at a first orientation for inductive transmission of at least one of power and communications;

a second coil arranged at a second orientation for inductive transmission of at least one
15 of power and communications, said first orientation being different from said second orientation; and

an electronic circuit electrically connected to said first coil and said second coil, said electronic circuit providing at least one of power and communication to said first coil and said second coil, whereby said first coil and said second coil induce magnetic fields at distinct
20 orientations.

10. The inductive coil assembly of claim 9 further comprising a third coil at a third orientation for inductive reception or inductive transmission of at least one of power and

communications, said first orientation being substantially perpendicular to said second orientation and said third orientation, said second orientation being substantially perpendicular to said third orientation.

11. An inductively powered device comprising:

5 an electric load requiring electric power for operation;

an inductive coil assembly having a plurality of coils, each of said coils arranged at a distinct physical orientation, each of said coils electrically connected to said load;

a rectifier for rectifying an alternative current induced in said coils, said rectifying means being electrically connected with each of said coils, whereby direct current is applied to
10 said load.

12. The inductive coil assembly of claim 11 further comprising a third coil at a third orientation, said third orientation being different from said first orientation and said second orientation.

13. The inductive coil assembly of claim 12 wherein said first orientation is substantially
15 perpendicular to said second orientation.

14. The inductive coil assembly of claim 13 wherein said second orientation is substantially perpendicular to said third orientation; and

said third orientation is substantially perpendicular to said first orientation.

15. The inductive coil assembly of claim 14 further including a bobbin; and

20 wherein each of said first coil, said second coil, and said third coil are wrapped about said bobbin.

16. The inductive coil assembly of claim 15 wherein said bobbin include a first spool, a second spool and a third spool.
17. The inductive coil assembly of claim 16 wherein said first spool, said second spool and said third spool are integral with one another.
- 5 18. A secondary for an inductively powered device comprising:
- a first coil arranged at a first angular orientation;
- a second coil arranged at a second angular orientation, said first angular orientation being different from said second orientation; and
- circuit means for electrically connecting said first coil and said second coil with a
- 10 common load.
19. The secondary of claim 18 wherein said first angular orientation and said second angular orientation are about ninety degrees apart.
20. The secondary of claim 19 further comprising a third coil arranged at a third angular orientation, said third angular orientation being different from said first orientation and said
- 15 second orientation.
21. The secondary of claim 20 wherein said first angular orientation, said second angular orientation and said third angular orientation are each about ninety degrees apart from one another.
22. The secondary of claim 21 further comprising a capacitor connected in series between
- 20 said load and each of said first coil, said second coil and said third coil.

23. The secondary of claim 20 wherein said first coil, said second coil and said third coil are electrically connected in a half-bridge arrangement with a diode connected in series between said load and each of said first coil, said second coil and said third coil.

24. The secondary of claim 20 wherein said first coil, said second coil and said third coil are electrically connected in a full bridge arrangement with a pair of diodes connected in series between said load and opposite sides of each of said first coil, said second coil and said third coil.

25. The secondary of claim 20 wherein said first coil, said second coil and said third coil are wrapped about a common bobbin.

26. The secondary of claim 20 wherein said first coil, said second coil and said third coil are wrapped about a common substantially spherical bobbin.

27. The secondary of claim 20 wherein said first coil is wrapped about a first bobbin, said second coil is wrapped about a second bobbin and said third coil is wrapped about a third bobbin.

28. The secondary of claim 27 wherein said first bobbin is fitted within said second bobbin and said second bobbin is fitted within said third bobbin.

29. The secondary of claim 27 wherein said first bobbin has a first diameter, said second bobbin has a second diameter and said third bobbin has a third diameter, said first diameter being smaller than said second diameter, said second diameter being smaller than said third diameter; and

wherein said first coil includes a greater number of turns than said second coil and said second coil includes a greater number of turns than said third coil.

30. The secondary of claim 18 wherein said first coil and said second coil are connected in parallel with said common load.

31. The secondary of claim 18 wherein said first coil and said second coil are connected in series with said common load.

5 32. An inductively powered device comprising:

a load; and

a secondary electrically connected to said load, said secondary including a first coil electrically connected with said load and a second coil electrically connected with said load, said first coil arranged at a first angular orientation, said second coil arranged at a second
10 angular orientation different from said first angular orientation.

33. The secondary of claim 32 wherein said first angular orientation and said second angular orientation are about ninety degrees apart.

34. The secondary of claim 33 further comprising a third coil arranged at a third angular orientation, said third angular orientation being different from said first orientation and said
15 second orientation.

35. The secondary of claim 34 wherein said first angular orientation, said second angular orientation and said third angular orientation are each about ninety degrees apart from one another.

36. The secondary of claim 34 further comprising a capacitor connected in series between
20 said load and each of said first coil, said second coil and said third coil.

37. The secondary of claim 34 wherein said first coil, said second coil and said third coil are electrically connected in a half-bridge arrangement with a diode connected in series between said load and each of said first coil, said second coil and said third coil.

38. The secondary of claim 34 wherein said first coil, said second coil and said third coil are electrically connected in a full bridge arrangement with a pair of diodes connected in series between said load and opposite sides of each of said first coil, said second coil and said third coil.

39. The secondary of claim 34 wherein said first coil, said second coil and said third coil are wrapped about a common bobbin.

40. The secondary of claim 34 wherein said first coil, said second coil and said third coil are wrapped about a common substantially spherical bobbin.

41. The secondary of claim 34 wherein said first coil is wrapped about a first bobbin, said second coil is wrapped about a second bobbin and said third coil is wrapped about a third bobbin.

42. The secondary of claim 41 wherein said first bobbin is fitted within said second bobbin and said second bobbin is fitted within said third bobbin.

43. The secondary of claim 42 wherein said first bobbin has a first diameter, said second bobbin has a second diameter and said third bobbin has a third diameter, said first diameter being smaller than said second diameter, said second diameter being smaller than said third diameter; and

wherein said first coil includes a greater number of turns than said second coil and said second coil includes a greater number of turns than said third coil.

44. The secondary of claim 34 wherein said first coil, said second coil and said third coil share a common origin.

45. The secondary of claim 34 wherein said first coil is nested within said second coil and said second coil is nested within said third coil.

5 46. An inductive coil assembly comprising:

first, second and third coils; and

a one-piece bobbin defining three spools for receiving said first, second and third coils, said first spool having an axis extending in a first direction, said second spool having an axis extending in a second direction substantially perpendicular to the first direction, said third
10 spool having an axis extending in a third direction substantially perpendicular to both said first direction and said second direction, said third spool including a plurality of inner guides and a plurality of outer guides, said inner guides and said outer guides being in a non-overlapping disposition in said third direction.

47. The inductive coil assembly of claim 46 wherein said first spool includes a pair of guide
15 walls extending in a direction substantially parallel to said third direction and said second spool including a pair of guide walls extending in a direction substantially parallel to said third direction.

48. The inductive coil assembly of claim 47 wherein said first coil includes a greater number of turns of wire than said second coil and said second coil of wire includes a greater
20 number of turns of wire than said third coil.

49. A bobbin for a three-axis inductive coil assembly, manufactured by a process including the steps of:

providing a first mold piece;

providing a second mold piece;

closing the first mold piece and the second mold piece together to cooperatively define a mold cavity, the mold cavity defining a first spool having an axis extending substantially
5 perpendicularly to a direction in which a molded part is removed from the mold, the mold cavity further defining a second spool having an axis extending substantially perpendicularly to the direction in which a molded part is removed from the mold, the mold cavity further defining a third spool having an axis extending substantially in the direction in which a molded part is removed from the mold, the third spool including a plurality of inner guides extending
10 substantially along a first plane and a plurality of outer guides extending substantially along a second plane, the first plane being spaced apart from the second substantially in the direction in which a molded part is removed from the mold, the plurality of inner guides being in non-overlapping relationship with the plurality of outer guides in the direction in which a molded part is removed from the mold;

15 injecting material into the mold cavity; and

removing the molded part from the cavity.

50. A bobbin for an inductive coil assembly comprising:

a spool having an axis and a pair of guide walls disposed on opposite sides of said spool, said guide walls extending substantially perpendicularly to said axis; and

20 a mounting arm extending from a first one of said guide walls, said mounting arm having a free end terminating in a first common plane with at least one of said guide walls, said first common plane extending parallel to said axis.

51. The bobbin of claim 50 wherein said mounting arm includes a first segment extending substantially perpendicularly to said axis and a second segment extending at an angle from said first segment.

52. The bobbin of claim 51 wherein said second segment extends substantially
5 perpendicularly to said axis.

53. The bobbin of claim 52 wherein a portion of said first guide wall and a portion of said mounting arm terminate in a second common plane.

54. The bobbin of claim 53 wherein said second common plane extends at approximately 45 degrees with respect to said axis.

10 55. An inductive coil assembly comprising:

a first coil arranged at a first orientation to receive at least one of inductively transmitted power and inductively transmitted communications;

a second coil arranged at a second orientation to receive at least one of inductively transmitted power and inductively transmitted communications, said first orientation being
15 different from said second orientation; and

an electronic device electrically connected to said first coil and said second coil, said electronic device receiving at least one of power and communication from at least one of said first coil and said second coil.